5.3.2 Am-241 and Cs-137 Gamma Ray Complications

The highest intensity gamma ray of ^{241}Am that effectively penetrates the 0.5-in. steel cased borehole is at 662 keV. However, there is a conflict with the single gamma ray emitted from ^{137}Cs (661 keV), which prevents the exclusive use of this gamma ray for measuring the concentration of ^{241}Am. As a result, the next most intense gamma ray (722 keV) is used to unequivocally identify and quantify or verify the concentration of ^{241}Am. The intensity (number of gamma rays produced per 100 disintegrations) are presented in Table 7.

Table 7 RWMC Radionuclides With 662 keV Gamma-Rays

Radionuclide	Gamma-Ray Energy (keV)	Gamma-Ray Intensity (%)	Conversion Factor*
Am-241	662.42	0.00078	115.7 (nCi/g) / (c/s)
		0.00042	212.3 (nCi/g) / (c/s)
Cs-137	661.67	84.6	1.067 (pCi/g) / (c/s)

* Conversion Factor from net photo peak count rate (c/s) to radionuclide concentrations are for the passive gamma logging probe: RLSG035A00S00.0 in casing with wall thickness of 0.50 inches.

The contribution of ^{137}Cs to the ^{241}Am gamma-ray is determined by processing the 662 keV photo peak count rate as if it were originating from ^{241}Am. The process to determine the contribution of ^{137}Cs to the 662 keV gamma-ray and apply a correction, if applicable, is as follows.

1. Examine the potential that no ^{241}Am is present.
   - Examine the uncertainty of the net photo peak at 662 keV. If strong 662 keV photo peaks are present with an uncertainties less than 10% and no 722 keV photo peak is identified in the interval of interest, then ^{137}Cs is present and no ^{241}Am is present.

2. Examine the potential ^{241}Am contribution to the 662 keV photo peak.
   - The concentration of ^{241}Am computed from the 662 and 722 keV photo peaks are compared. If the concentrations are equal, within counting statistics, then no ^{137}Cs is present.
   - If the concentration of ^{241}Am from the 662 keV photo peak exceeds the concentration computed from 722 keV by more than 3-sigma counting statistics then both ^{137}Cs and ^{241}Am are present in the interval. Establish the ^{137}Cs contribution factor by computing the ratio of concentrations from the 722 keV and 662 keV photo peaks.

5.3.3 Radionuclides That Produce Gamma-Ray Near 312 keV

Three radionuclides identified in waste buried at the RWMC produce gamma-rays with energies near 312 keV. This gamma-ray energy (312 keV) is the dominant one produced by ^{233}Pa (daughter product of ^{237}Np) and is used to compute the concentration of ^{233}Pa. The other two radionuclides are ^{241}Am and ^{239}Pu. At higher concentrations of these latter two radionuclides the 312 keV gamma-ray is detected in the HPGe spectroscopy measurements above background levels. The intensity (number of gamma rays produced per 100 disintegrations) are presented in Table 8 for each radionuclide, along with the conversion factor from net photo peak count rate activity (counts per second) to radionuclide concentration (pCi/g or nCi/g).

Table 8 RWMC Radionuclides With 312 keV Gamma-Rays

Radionuclide	Gamma-Ray Energy (keV)	Gamma-Ray Intensity (%)	Conversion Factor*
Pa-233	312	33.7	3.182 (pCi/g) / (c/s)
Am-241	662.42 721.96 311.94	0.00078 0.00042 0.00013	115.7 (nCi/g) / (c/s) 212.3 (nCi/g) / (c/s) 824.9 (nCi/g) / (c/s)
Pu-239	413.69 311.69	0.00151 0.00003	65.9 (nCi/g) / (c/s) 3575. (nCi/g) / (c/s)

* Conversion Factor from net photo peak count rate (c/s) to radionuclide concentrations for the passive gamma logging probe: RLSG035A00S00.0 in casing with thickness of 0.50 inches.

The contribution of ^{241}Am and ^{239}Pu to the dominant ^{233}Pa gamma-ray is determined by processing the 312 keV photo peak count rate as if it were originating from the two conflicting radionuclides (^{241}Am and ^{239}Pu). The process to determine the contribution to the 312 keV gamma-ray and apply a correction, if applicable, is as follows.

1. Examine the potential ^{241}Am contribution to 312 keV photo peak.
   - The concentration of ^{241}Am computed from the 662 and 722 keV photo peaks are compared and confirmed to be equal, within counting statistics, to verify that ^{137}Cs is not present.
   - Compare concentration of ^{241}Am computed from 662 keV gamma with the concentrations computed from the 312 keV gamma. If the concentrations are equal, within statistics, then all of the 312 keV photo peak activity is from ^{241}Am and there is no ^{233}Pa present.
   - Examine the ratio of concentration from 312 keV to 662 keV. If the ratio falls below 5, meaning that 20% of the 312 keV photo peak is from ^{241}Am, then a correction will be applied as described in step 3.

2. Examine the potential ^{239}Pu contribution to 312 keV photo peak.
   - The concentration of ^{239}Pu computed from 414 and 312 keV photo peaks are compared. If the concentrations are equal, within statistics, then all of the 312 keV photo peak activity is from ^{239}Pu and there is no ^{233}Pa present.
   - Examine the ratio of concentration from 312 keV to 414 keV. If the ratio falls below 5, meaning that 20% of the 312 keV photo peak is from ^{239}Pu, then a correction will be applied as described in step 3.

3. Compute the concentration of ^{233}Pa from the 312 keV photo peak.
   - If ^{241}Am and ^{239}Pu contribute more than 90% to the 312 keV photo peak then no ^{233}Pa is present.
   - If ^{241}Am and ^{239}Pu contribute less than 20% to the 312 keV photo peak then the computed concentration of ^{233}Pa is not corrected.
   - If ^{241}Am and ^{239}Pu contributes more than 20% but less than 90% to the 312 keV photo peak then the apparent concentration of ^{233}Pa is corrected (decreased) by the amount of contribution from the conflicting radionuclides.

5.4 Neutron-Capture / Spectral-Gamma Data Processing

The n-Gamma data processing is a multiple step algorithm that uses the LGCALC software program described above for the passive spectral logging tool.

The first step in the data processing algorithm is to locate two signature photo peaks in the first survey spectra and evaluate their apparent energy location to determine if an adjustment to the channel to gamma ray energy conversion factor is required. The two signature photo peaks are the 2223 keV of hydrogen and the iron doublet at 7630 and 7645 keV. Adjustment to the channel to energy conversion factor does not effect the count rate activity in the photo peaks or the computed net peak area. Minor adjustments to the gain conversion factor are required for several hours after electrical power is applied to the tool. Additionally, if tool power must be interrupted to fill the detector dewar, or for any other reason, there may be a need for minor adjustments to the channel to energy conversion factor when power is reapplied.

In the second step of the data processing algorithm, LGCALC scans the spectra, locates all photo peaks, and computes their net count rate and uncertainty. LGCALC computes the net area in the gamma ray peak and calculates the dead-time corrected count rate.

The dead-time corrected net peak count rate for selected gamma ray peaks of each element is output in a tabular file. The elements and gamma rays identified in the n-Gamma spectra for the RWMC logging are given below in Table 9.

An example of a n-Gamma spectrum from the Pit 9 study area is shown in Figure 11. The gamma ray photo peaks processed and elements of interest for the RWMC project are labeled in the figure. The other non-labeled photo peaks present on the n-Gamma spectra are from the numerous gamma rays generated from: iron, calcium, silicon, and chlorine.

5.4.1 Influences to n-Gamma Probe Responses

The n-Gamma log response is influenced by changes in both the borehole and formation environments. The main source of changes in the RWMC study area (other than non-uniform distributions) are related to changes in the formation environment (i.e. waste zone, overburden, and underburden) that effect the neutron cloud flux density. The neutron flux (cloud) density is effected by variations in neutron absorbers in the formation materials, the presence of void spaces within or between the buried waste materials, and changes in moisture content.

Table 9 Gamma Ray Table for n-Gamma Probe

Atomic Element	Gamma Ray (keV)	Gamma Intensity (%)	Cross Section (Barns)
Al	1778	88	0.23
Ca	1942 3907	73 15	0.43
Cl	1164 1951 1959 6111 6620	20 22 15 15.8 10	33.20
Fe	6018 7631 7645	9 28 24	2.55
H	2223	100	0.33
Si	3539 4934	68 63	0.16

Review of the n-Gamma log responses suggests that the neutron cloud is highly variable and that corrections to the log responses for variations in the neutron cloud are necessary in order to accurately quantify the concentration of the various elements, even hydrogen and chlorine. The reported content of chlorine must be corrected for changes in the neutron cloud and is, therefore, reported as dead-time corrected net photo peak count rate (as with the other n-Gamma log responses).

The 1778 keV photo peak from the n-Gamma logging can be generated by two neutron reactions. One reaction is the activation of aluminum that emits the 1778 keV gamma ray when the activated aluminum returns to the natural state. The other reaction is through an inelastic collision of a fast neutron with silicon, which emits the 1778 keV gamma ray when it returns to the normal state. Therefore, the n-Gamma log is labeled as the energy of the gamma ray (1778 keV), since the two sources can not be separated without other information.

6.0 BOREHOLE SURVEY RESULTS

The survey specifications for each logging probe used in RWMC boreholes are given below in Table 10. Due to the internal configurations of the logging tool detectors, electronics, and dewars (for the HPGe detectors), measurements could not be acquired to the total depths drilled. The maximum depths achievable with each logging tool relative to the bottom of a borehole are shown in the table.

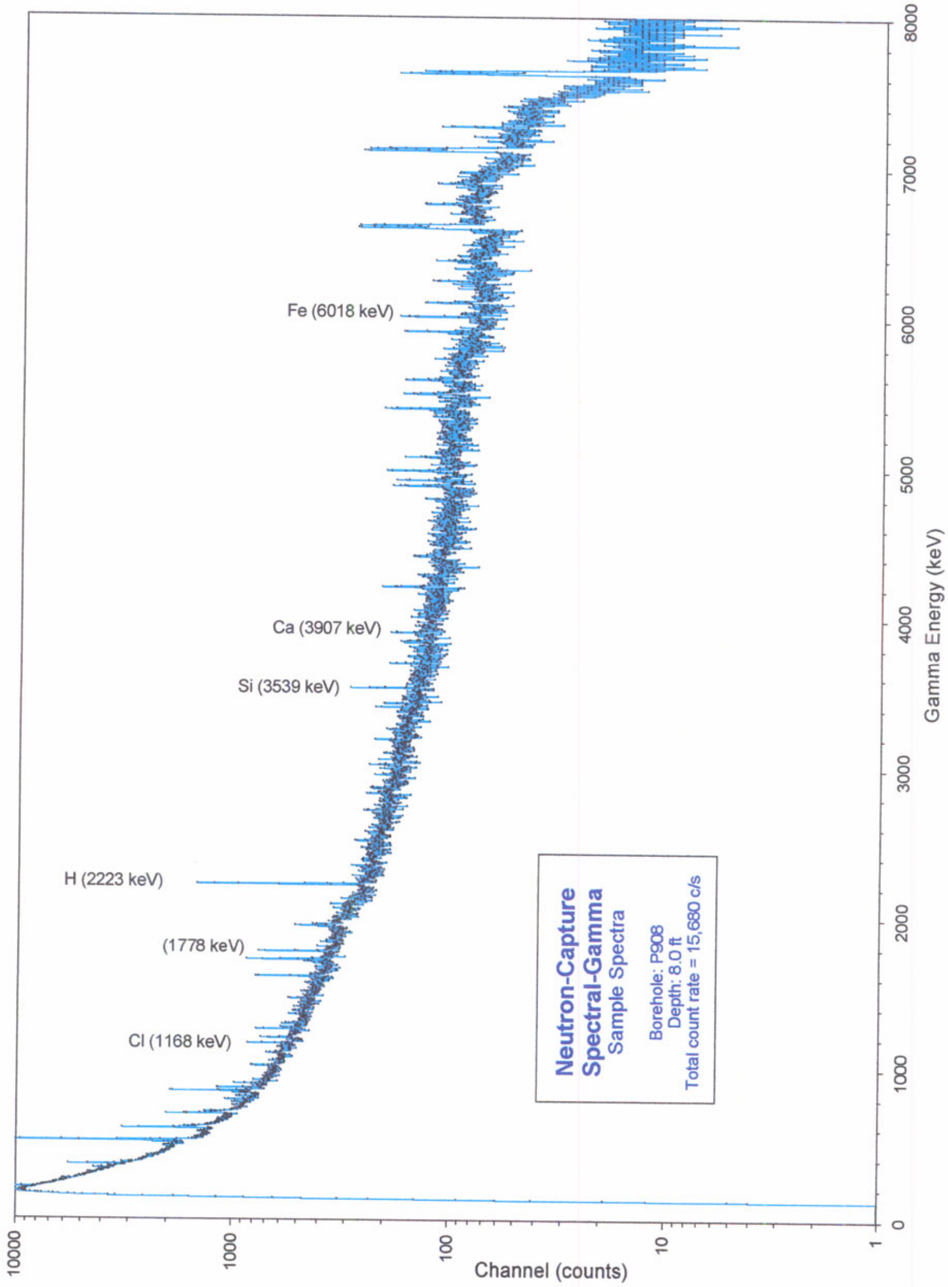

Figure 11 Example of a n-Gamma Spectrum

Table 10 Borehole Survey Logging Specifications

Probe Type	Depth Increment	Logging Mode	Detector Distance Above Tool Bottom
Neutron-moisture	0.25 ft	Fixed Velocity (0.7 ft/min)	0.26 ft
Passive Spectral-gamma	0.5 ft	Move-Stop-Acquire 200 sec RT* ea. Depth	0.30 ft
Passive-neutron	0.5 ft	Fixed Velocity (0.7 ft/min)	0.73 ft
Neutron-Capture / Spectral-Gamma	0.5 ft	Move-Stop-Acquire 200 sec RT* ea. Depth	1.33 ft

* RT – real (clock) time

The survey for each probe type and each borehole is stored in a separate disk directory. A separate file containing the detector response data is created for each survey depth increment. The name for each detector response file is 8 characters long with the form "xxxxyzzz.CHN".

Where:

xxxx is the 4 character survey file name prefix identifier (unique for each survey),
y is the MCA (Multi-Channel Analyzer) number (i.e. "1" for the HPGe probe types, "2" for the neutron-moisture and passive neutron probes)
zzz is the 3 character file sequence number (000 thru 999),
CHN is the file name extension (Ortec, integer PHA spectra file format)

The four character unique file name prefix for each borehole survey are shown in Table 11.

The survey results for each logging tool are presented as a composite log plot at the end of this section. The log data plots and discussion of the plots are the final products of logging. There is one composite plot for each borehole surveyed. The composite plots contain the survey results for the (1) neutron-moisture, (2) passive-neutron, (3) passive spectral-gamma, and (4) neutron-capture / spectral-gamma probes. The annotations on the plots are as follows: neutron, moisture (Moist), hydrogen (H), chlorine (Cl), plutonium-239 (^{239}Pu), protactinium-233 (^{233}Pa) which is the daughter isotope of neptunium-237 (^{237}Np), uranium-238 (^{238}U), uranium-235 (^{235}U), cesium-137 (^{137}Cs), americium-241 (^{241}Am), silicon (Si), iron (Fe), and calcium (Ca), and the natural radionuclides (i.e. potassium (K), uranium (U), and thorium (Th)). Gamma ray photo peaks that have not been associated with a specific radionuclide in the RWMC waste are identified on the composite plot by the energy (keV).

Table 11 Borehole Survey File Prefix Names

Borehole ID	Spectral-Gamma Survey File Prefix	Moisture Survey File Prefix	Passive Neutron File Prefix	Neutron-Capture/ Spectral-Gamma File Prefix
P9-2-1A	P069	P056	P9G7	P9H5
P9-2-2	P063,P066,P071	P054	P9G9	P9H7
P9-2-3	P058	P052	P074	P9H3
P9-2-4A	P060	P055	P9G8	P9H6
P9-2-5A	P062	P050	P073	P9H2
P9-2-6A	P059	P057	P076	P9H4
P9-2-7	P064	P053	P072	P9H9
P9-2-8A	P061	P051	P075	P9H1
P920	P070	P078,P079	P9H0;P065;P077	P9H8

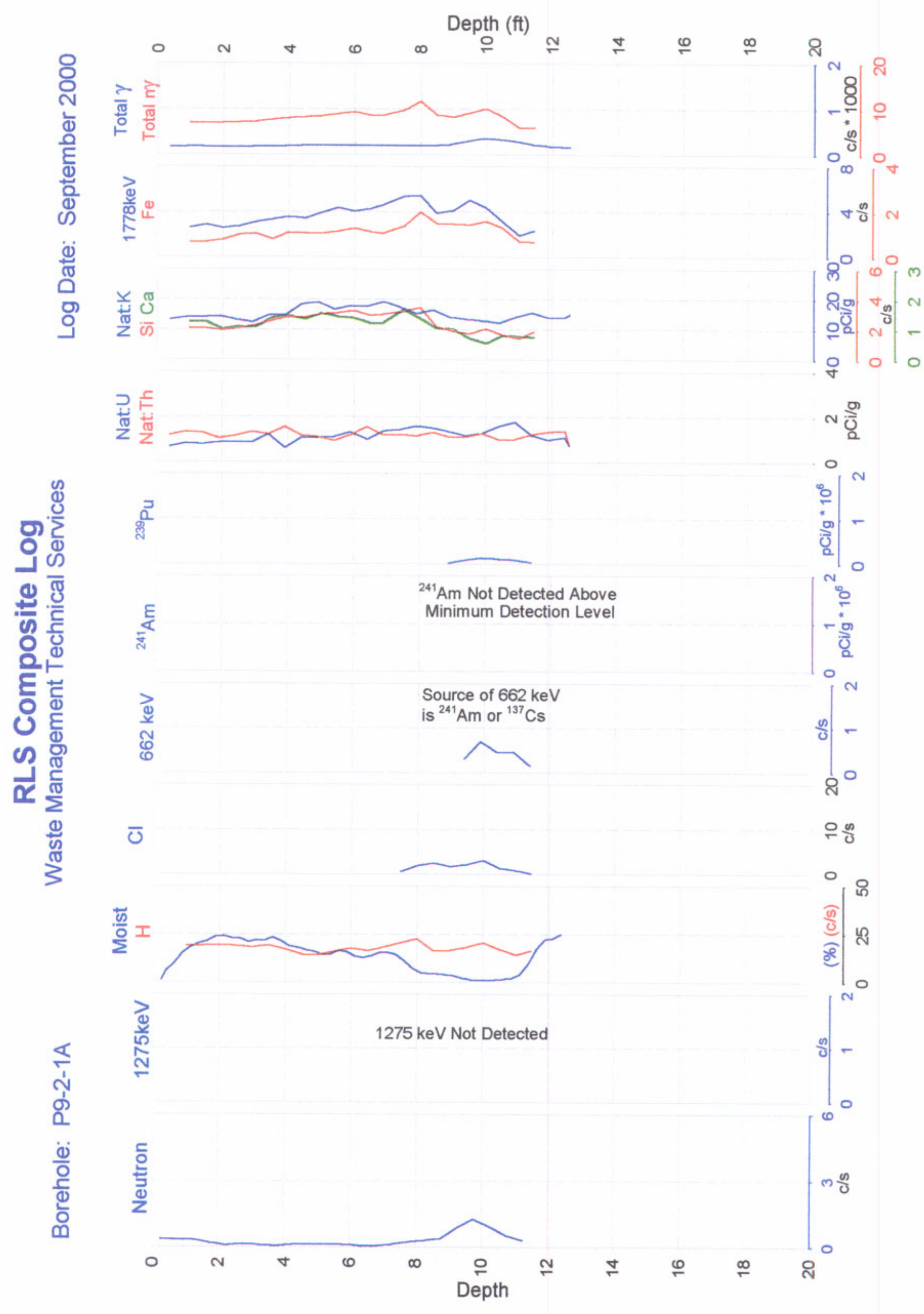

Figure 12 Composite Plot for Borehole P9-2-1A

6.1 Borehole P9-2-1A Survey Results

- Total casing depth is 13.25 ft.
- The waste zone extends from 7 ft to 11 ft. Chlorine was detected at the maximum survey depth of 11.45 ft.
- Passive-neutron detected elevated activity (up to 1.2 c/s) from 8 to 11 ft. The passive-neutron distribution profile is similar to the Pu-239 distribution.
- The hydrogen log increased slightly in the waste. The neutron-moisture log decreased in the waste zone to 1 wt% at 10 ft.
- Chlorine was detected between 7 ft and the maximum survey depth of 11.45 ft with a maximum activity of 1 c/s at 10 ft.
- Americium-241 and possibly Cesium-137 are present. The apparent concentration of Am-241 from the 662 keV photo peak is 4-times greater than the concentration computed from the 722 keV peak. The maximum 662 keV photo peak activity is 0.7 c/s at 10 ft.
- Plutonium-239 was detected from 9 to 12 ft at a maximum concentration of 130 nCi/g at 10 ft.
- Natural radionuclides: Potassium activity increases slightly in the over-burden (4 to 8 ft). Uranium and thorium show little change between the over-burden, waste, and under-burden zones, as is typical for the Pit 9 study area.
- Silicon, calcium responses decreased in the waste zone between depths of 8 and the maximum survey depth of 11.45 ft.
- Iron and the 1778 keV had two zones of increased response in the waste zone (8 and 10 ft).

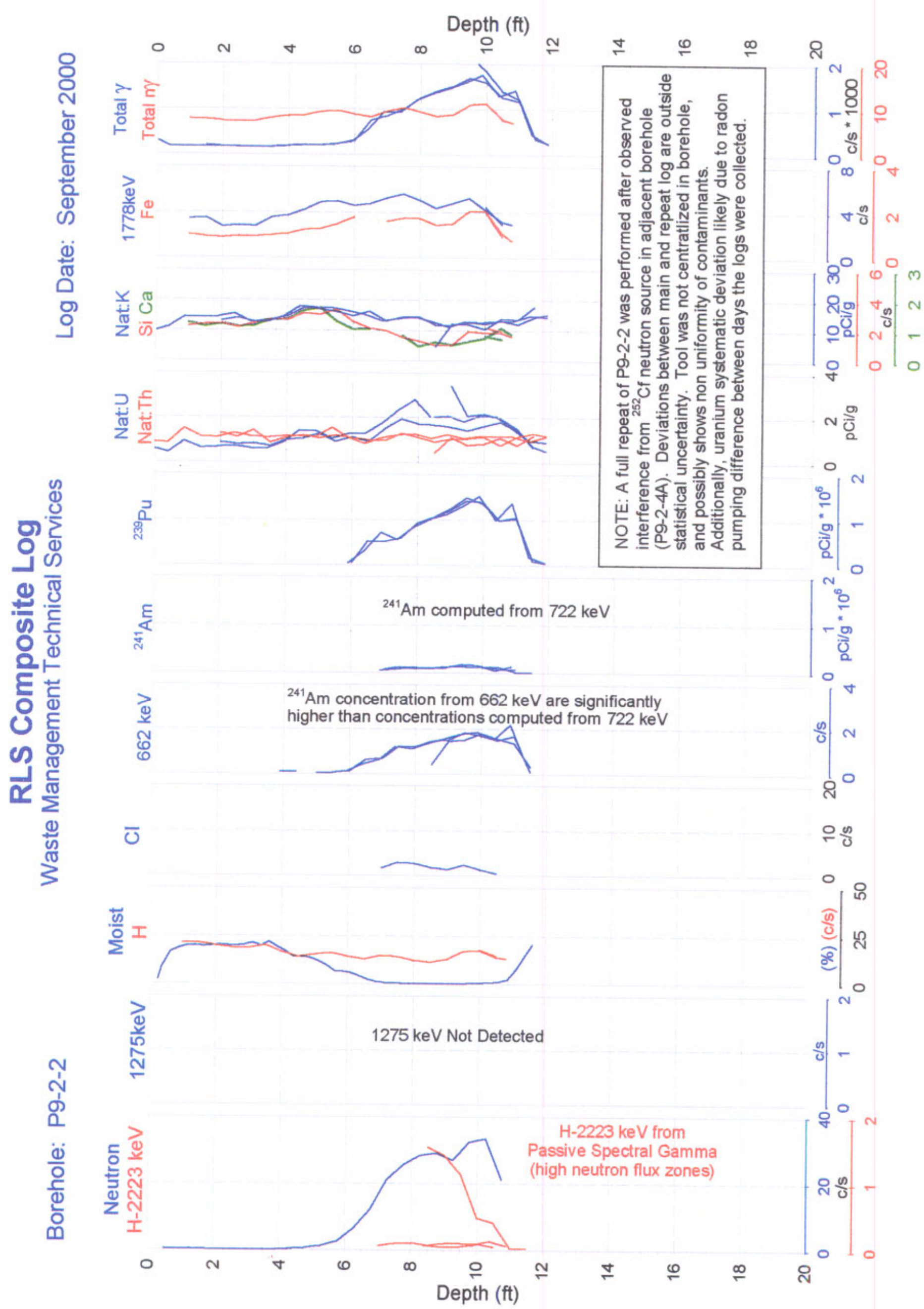

Figure 13 Composite Plot for Borehole P9-2-2

6.2 Borehole P9-2-2 Survey Results

- Total casing depth is 12.7 ft.
- The waste zone extends from 6 ft to 11 ft.
- A full passive gamma repeat survey was performed after interference was observed (high total-gamma and H-2223 keV curves) from the nGamma neutron source (Cf-252) in an adjacent probe hole (P9-2-4A) on the repeat section of the main survey (11-8.5 ft). Deviations between main and full repeat log are outside statistical uncertainty (see Table 12). Systematic deviations in Natural Uranium are likely due to radon pumping between days logs were collected.

Table 12 P9-2-2 Main and Repeat Log Deviations

	Depth	Pu-239	662 keV
Main Log	10.9 ft	1374 $\pm$ 1.7%	2.2 $\pm$ 5.7%
Repeat Log	11 ft	1028 $\pm$ 2%	1.68 $\pm$ 6.9%

- Passive-neutron detected increased activity from 5 to the maximum survey depth of 10.75 ft with a maximum count rate of 33 c/s at 10 ft. The 2223 keV photo peak from hydrogen (associated with high neutron background) was detected from 7 to 11 ft at count rates less than 0.2 c/s.
- The neutron-moisture log decreased in the waste zone to less than 1 wt% as is typical for the Pit 9 study area. The hydrogen log from the nGamma survey shows a slight increase in the lower portion of the waste zone (10 ft).
- Chlorine was detected at low levels from 7 to 11 ft with a maximum activity up to 3 c/s at 8 ft.
- Americium-241 and possibly Cesium-137 are present. The apparent concentration of Am-241 from the 662 keV photo peak is up to two times greater at 11 ft than the concentration computed from the 722 keV peak. The maximum 662 keV photo peak activity is 2 c/s at 11 ft. The Am-241 concentrations computed from 662 and 722 keV are statistically equivalent from 7 to 10 ft.
- Plutonium-239 was detected from 6 to 12 ft at a maximum concentration of 1500 nCi/g at 10 ft.
- Natural radionuclides: Potassium activity increases slightly in the over-burden (4 to 7 ft). Radon pumping (log barometric pressure) probably caused the uranium (Bi-214 and Pb-214) to be higher through the waste zone on the main survey (11/10/2000) than on the repeat survey (11/12/2000).
- Silicon, calcium responses decreased in the waste zone between depths of 6 and the maximum survey depth of 10.8 ft.
- Iron and the 1778 keV increased from 5 to 10 ft.

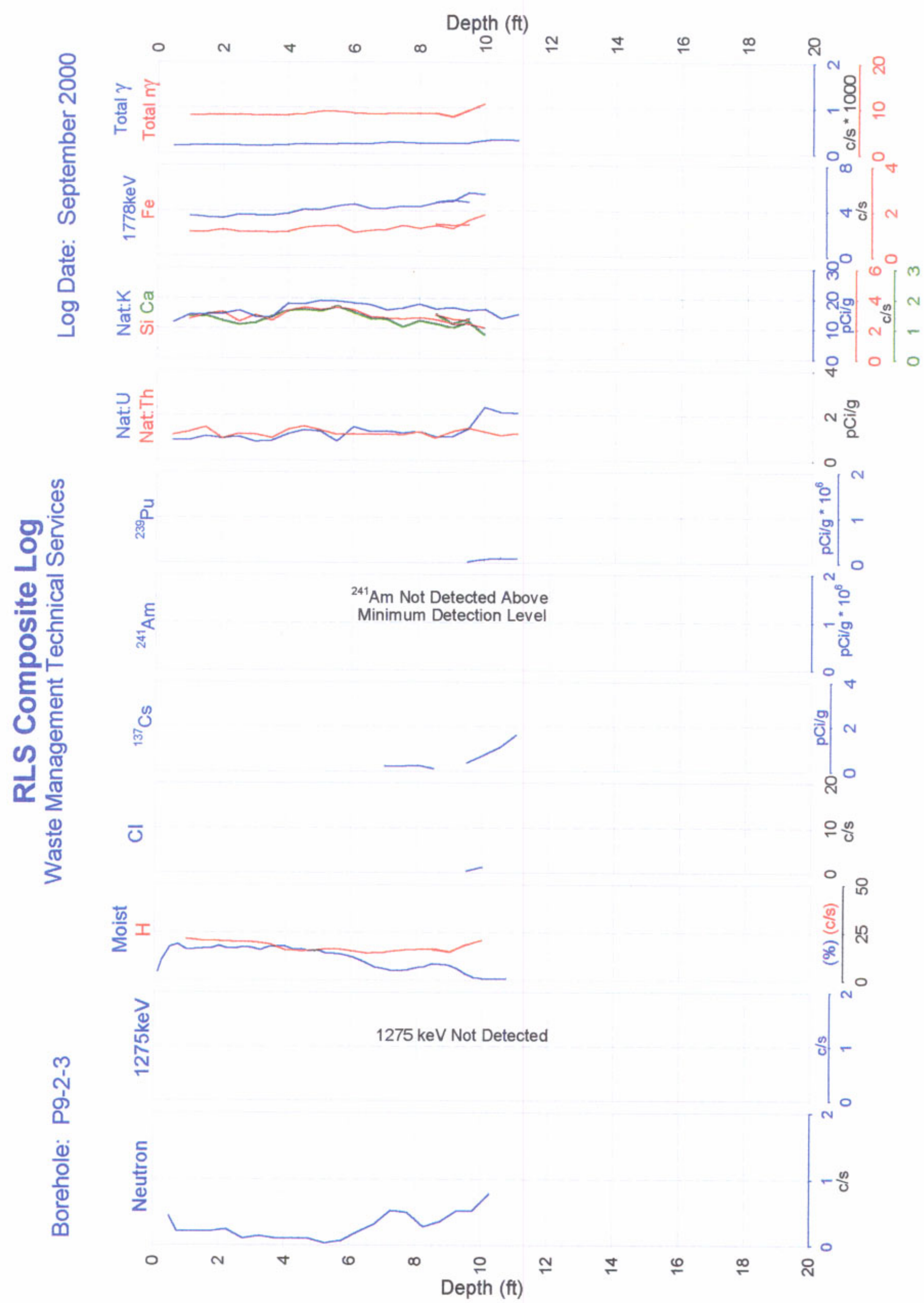

Figure 14 Composite Plot for Borehole P9-2-3

6.3 Borehole P9-2-3 Survey Results

- Total casing depth is 11.36 ft.
- The waste zone extends from 7 ft to the maximum survey depth of 11 ft. Plutonium-239, cesium-137, chlorine and high passive neutron activity were detected at the maximum survey depth, indicating that the borehole did not penetrate through the waste zone.
- Passive-neutron detected slightly elevated activity (up to 0.8 c/s) from 7 to the maximum survey depth of 10.25 ft.
- The hydrogen log showed a slight increase at the bottom of the borehole where Pu-239 was detected. The neutron-moisture log decreased in the waste zone to 1 wt% at 10 ft.
- Chlorine was detected at low levels (1.2 c/s) at the bottom of the probehole.
- Cesium-137 was detected (no 722 keV photo peak detected) from 9 ft to the maximum survey depth of 11 ft at concentrations up to 1.6 pCi/g at 11 ft.
- Americium-241 may be present from 6 to 9 ft (below minimum detection threshold) at concentrations less than 30 nCi/g.
- Plutonium-239 was detected from 9 ft to the maximum survey depth of 11 ft at concentrations less than 100 nCi/g.
- Natural radionuclides: Uranium shows an increase (almost twice the concentrations) at the bottom of the borehole in the waste zone to 2.1 pCi/g.
- Silicon, calcium responses decreased slightly in the waste zone.
- Iron and the 1778 keV increased slightly in the waste zone.

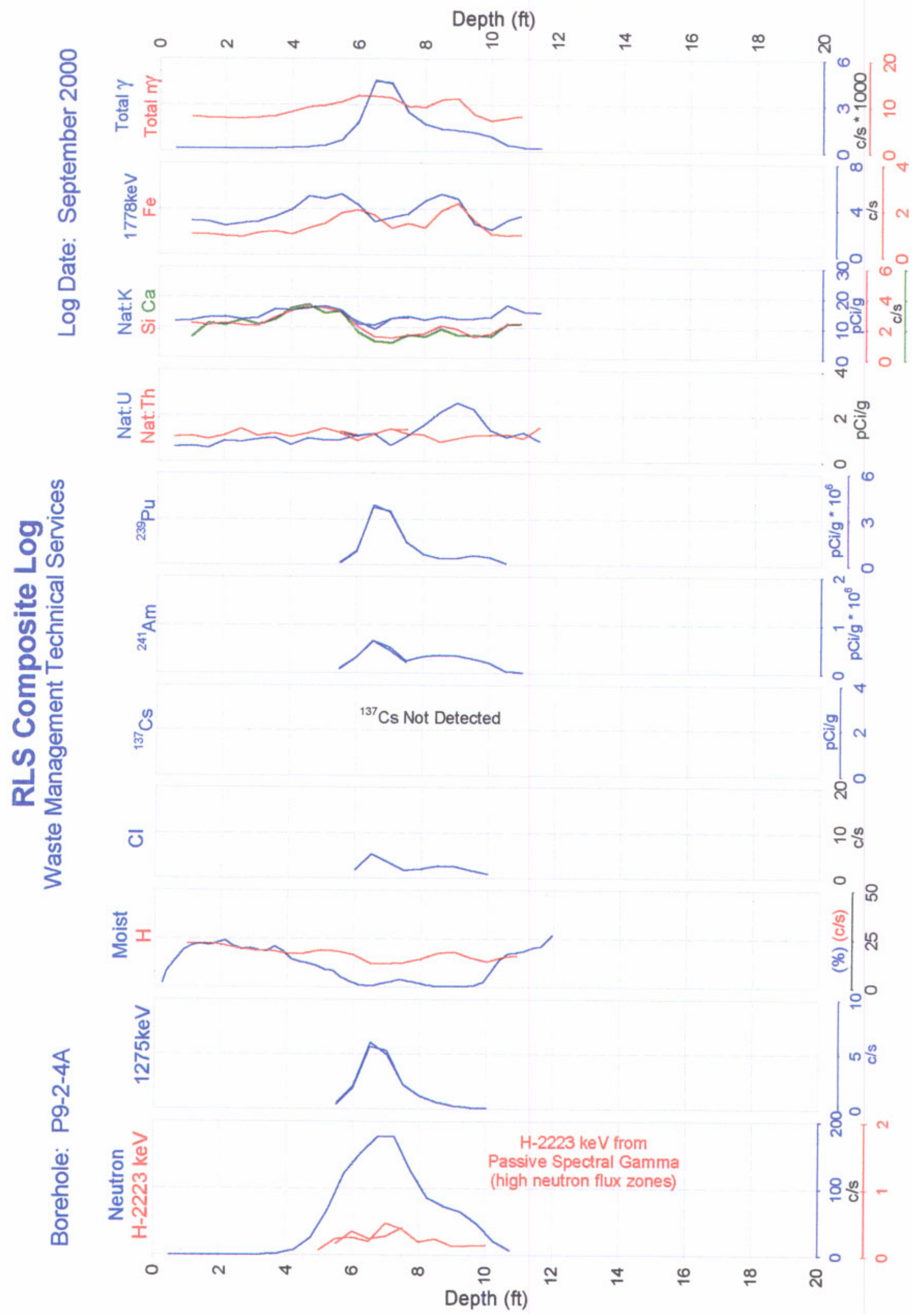

Figure 15 Composite Plot for Borehole P9-2-4A

6.4 Borehole P9-2-4A Survey Results

- Total casing depth is 12.70 ft.
- The waste zone extends from 5 ft to 11 ft. The maximum concentration of plutonium, americium, and passive-neutron activity encountered in the 8 additional boreholes discussed in this report were detected in this borehole.
- Passive-neutron detected high activity from 5 to 11 ft with maximum activity of 175 c/s at 7 ft. The passive-neutron distribution profile is similar to the Am-241 and Pu-239 distribution and the photo peak (1275 keV) associated with high passive-neutron background activity are similar.
- The 1275 keV photo peak is the highest encountered in the 8 additional boreholes with a maximum count rate activity of 5.7 c/s at 7 ft. The ratio of passive-neutron to 1275 keV count rate activity (177 to 5.7 c/s or 31:1) is mid range between the ratio of activity encountered in the P9-2-7 and the P920 boreholes.
- The hydrogen log decreased slightly in the waste zone interval (6 to 8 ft) where higher concentrations of chlorine were detected. The neutron-moisture log decreased in the waste zone to 1 wt% at 7 ft and between 8 and 10 ft.
- Chlorine was detected from 6 ft to 10 ft with a maximum activity of 5.3 c/s at 6.5 ft, which is the second highest encountered in the 8 additional boreholes.
- Americium-241 is present from 5 to 11 ft at concentrations up to 660 nCi/g at 7 ft. The proportion of Americium-241 to Plutonium-239 is higher for this borehole than for the other boreholes presented in this report. The ratio of Am-241 to Pu-239 is 660 to 3700 (1:5.6) for borehole P9-2-4A while the ratio for the other boreholes ranges from 1:8.4 to 1:10.5.
- Plutonium-239 is present in the same interval as Am-241 from 5 to 11 ft at concentration up to 3700 nCi/g at 7 ft.
- Natural radionuclides: Uranium shows an increase in the lower portion of the waste zone (8 to 10 ft) up to 2.5 pCi/g.
- Silicon and calcium responses decrease in the waste zone from 6 to 10 ft.
- Iron and the 1778 keV had two zones of increased response, but at slightly different depths. One zone is above the waste zone and the other depth is in the waste zone.

6.4 Borehole P9-2-4A Survey Results

- Total casing depth is 12.70 ft.
- The waste zone extends from 5 ft to 11 ft. The maximum concentration of plutonium, americium, and passive-neutron activity encountered in the 8 additional boreholes discussed in this report were detected in this borehole.
- Passive-neutron detected high activity from 5 to 11 ft with maximum activity of 175 c/s at 7 ft. The passive-neutron distribution profile is similar to the Am-241 and Pu-239 distribution and the photo peak (1275 keV) associated with high passive-neutron background activity are similar.
- The 1275 keV photo peak is the highest encountered in the 8 additional boreholes with a maximum count rate activity of 5.7 c/s at 7 ft. The ratio of passive-neutron to 1275 keV count rate activity (177 to 5.7 c/s or 31:1) is mid range between the ratio of activity encountered in the P9-2-7 and the P920 boreholes.
- The hydrogen log decreased slightly in the waste zone interval (6 to 8 ft) where higher concentrations of chlorine were detected. The neutron-moisture log decreased in the waste zone to 1 wt% at 7 ft and between 8 and 10 ft.
- Chlorine was detected from 6 ft to 10 ft with a maximum activity of 5.3 c/s at 6.5 ft, which is the second highest encountered in the 8 additional boreholes.
- Americium-241 is present from 5 to 11 ft at concentrations up to 660 nCi/g at 7 ft. The proportion of Americium-241 to Plutonium-239 is higher for this borehole than for the other boreholes presented in this report. The ratio of Am-241 to Pu-239 is 660 to 3700 (1:5.6) for borehole P9-2-4A while the ratio for the other boreholes ranges from 1:8.4 to 1:10.5.
- Plutonium-239 is present in the same interval as Am-241 from 5 to 11 ft at concentration up to 3700 nCi/g at 7 ft.
- Natural radionuclides: Uranium shows an increase in the lower portion of the waste zone (8 to 10 ft) up to 2.5 pCi/g.
- Silicon and calcium responses decrease in the waste zone from 6 to 10 ft.
- Iron and the 1778 keV had two zones of increased response, but at slightly different depths. One zone is above the waste zone and the other depth is in the waste zone.

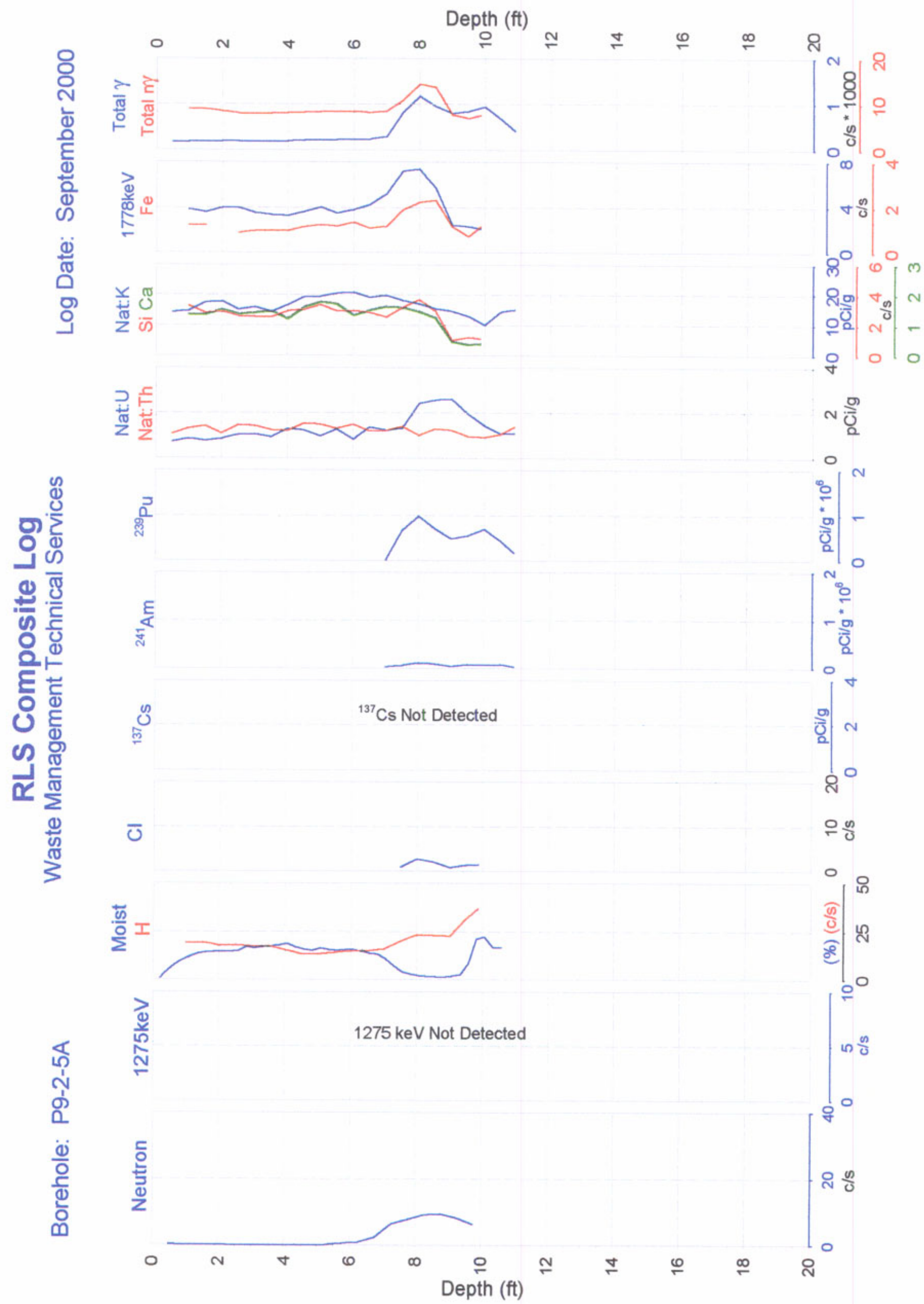

Figure 16 Composite Plot for Borehole P9-2-5A

6.5 Borehole P9-2-5A Survey Results

- Total casing depth is 11.20 ft.
- The waste zone is deeper than in adjacent boreholes and extends from 7 ft to the maximum survey depth of 11 ft. Chlorine, Am-241, and Pu-239 were detected at the maximum survey depth, indicating that the borehole did not penetrate through the waste.
- Passive-neutron detected elevated activity from 6 ft to the maximum survey depth of 9.75 ft with count rates up to 9 c/s.
- The hydrogen log increased slightly in the waste and again at the bottom of the borehole. The neutron-moisture log decreased in the waste zone down to 1.5 wt% at 9 ft. An unusual distribution profile at the bottom of the borehole was encountered which appears to be rapidly changing conditions.
- Chlorine was detected between 7 ft and the maximum survey depth of 10 ft with a maximum activity of 2.7 c/s at 8 ft.
- Americium-241 is present from 7 to the maximum survey depth of 11 ft. The maximum concentration measured is 110 nCi/g at 8 ft.
- Plutonium-239 was detected from 7 to the maximum survey depth of 11 ft at a maximum concentration of 990 nCi/g at 8 ft.
- Natural radionuclides: Potassium concentration increase slightly from 4 to 10 ft. Uranium (Bi-214) increases (up to 2.5 pCi/g) in the waste zone (7 to 10 ft).
- Silicon and calcium responses decreased in the lower portion of the waste zone, from 9 ft to the maximum survey depth of 9.75 ft.
- Iron and the 1778 keV both increased in the upper portion of the waste zone (7 to 9 ft), and like other probe holes in the area the depths are slightly offset.

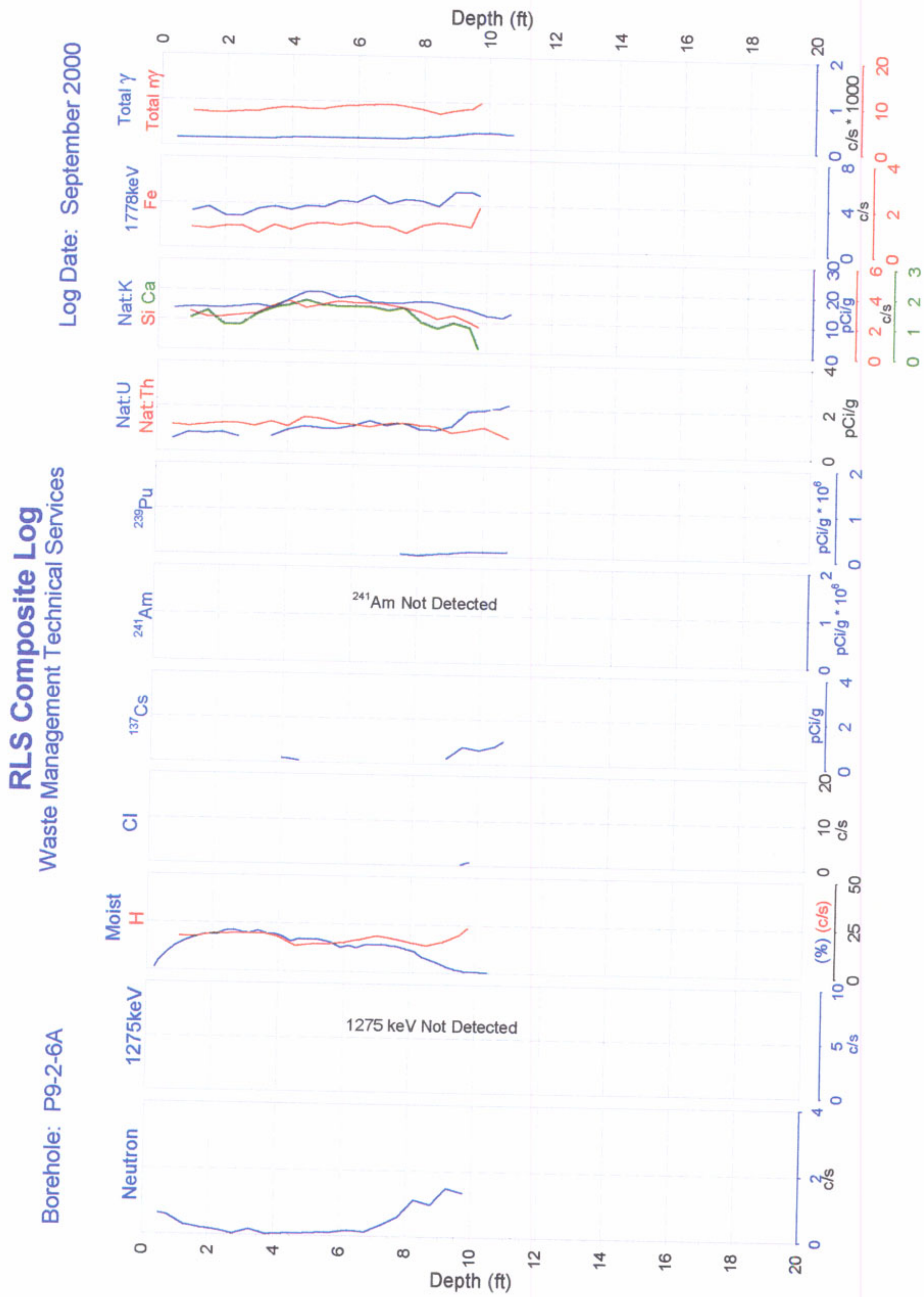

Figure 17 Composite Plot for Borehole P9-2-6A

6.6 Borehole P9-2-6A Survey Results

- Total casing depth is 11.13 ft.
- The waste zone is not clearly defined, but appears to extend from 7 ft to the maximum survey depth of 11 ft. The maximum activity of the passive-neutron, chlorine, and radioactive contaminants occurred at the maximum survey depth. Indicating that the borehole did not extend all of the way through the waste zone.
- Passive-neutron activity is elevated (up to 1.3 c/s) from 7 to the maximum survey depth of 9.74 ft.
- The hydrogen log increased slightly in the waste. The neutron-moisture log response decreased in the waste zone to less than 1 wt% at the maximum survey depth of 10.3 ft.
- Chlorine was detected at the bottom of the probe hole at count rates less than 1 c/s.
- Americium-241 if present is less than the non-detect limit of the survey. The 722 keV photo peak may have been detected in only one spectra (9.5 ft) with an uncertainty of 42%. Therefore all 662 keV phot peaks were processed at Cesium-137. The apparent maximum concentration of Cs-137 is 1 pCi/g at the maximum survey depth of 10.75 ft.
- Plutonium-239 was detected from 7 ft to the maximum survey depth of 10.75 ft at concentrations up to 110 nCi/g.
- Natural radionuclides: Uranium (Bi-214) shows an increase in the waste zone (9 to 11 ft) up to 2.2 pCi/g.
- Silicon and calcium responses decreased in the waste zone.

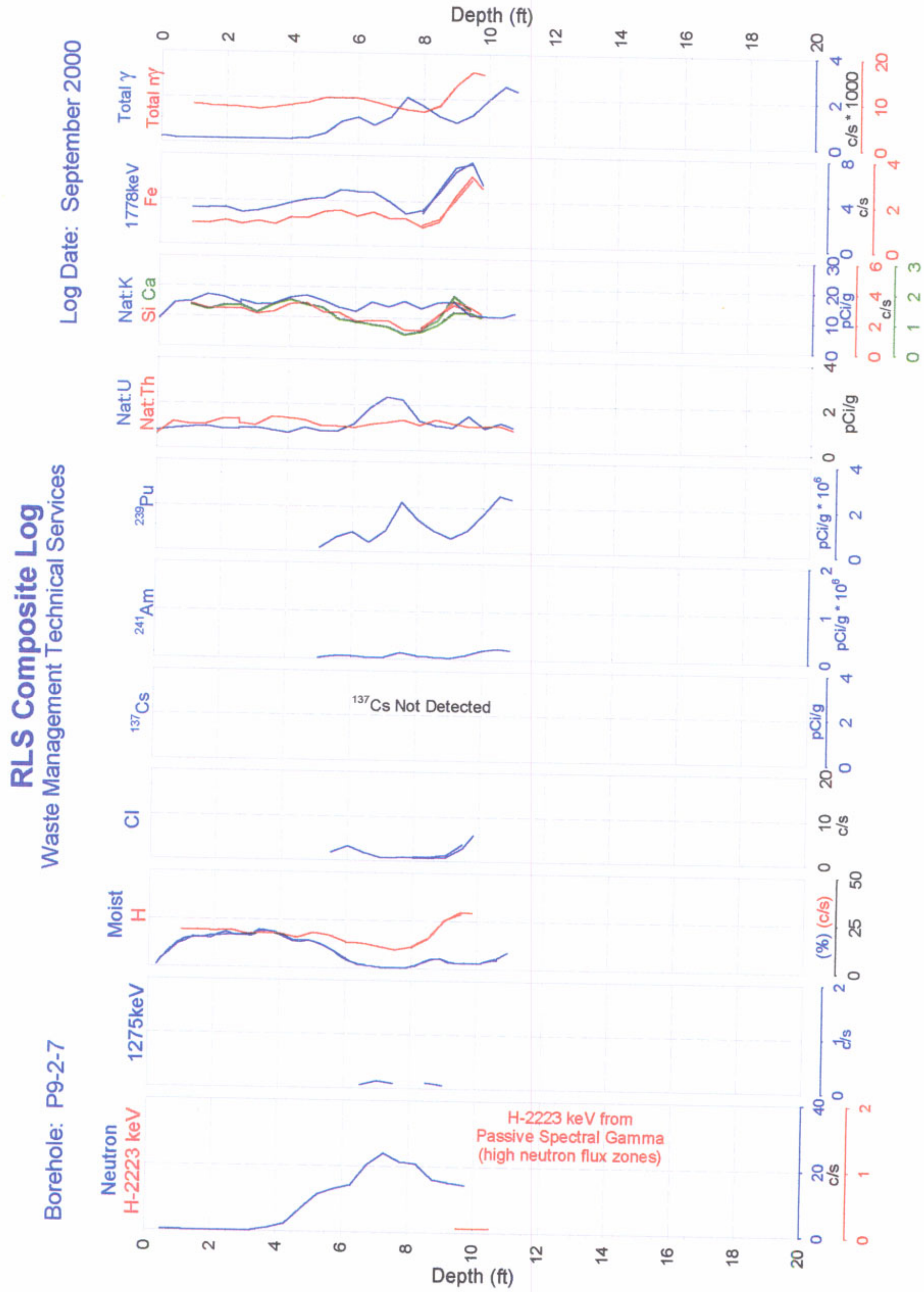

Figure 18 Composite Plot for Borehole P9-2-7